WHAT IS CLAIMED IS:

1. A semiconductor device comprising a semiconductor region having a plurality of semiconductor crystalline grains joined with {111}-twin boundaries of Diamond structure and a gate electrode covering the surface of said semiconductor region via an insulating film.

2. A semiconductor device comprising an insulator; a semiconductor layer having a plurality of semiconductor crystalline grains provided at the upper part of said insulator to have one main surface, said semiconductor crystalline grains having {110}- planes to form said main surface, the interfaces of which are joined by {111} twin-boundaries; and a gate electrode covering said main surface of said semiconductor layer via an insulating film.

3. A thin-film semiconductor device comprising an insulator, a thin-film semiconductor layer provided at the upper part of said insulator to have a source region and drain region which are separated from each other, a gate insulating film covering the surface portion of said semiconductor layer between said source region and said drain region, and a gate electrode provided on said gate insulating film, said semiconductor layer provided between said source region and said drain region comprising a plurality of semiconductor crystalline grains joined with {111} twin-boundaries of Diamond structure.

4. A thin-film semiconductor device comprising an insulator, a polycrystalline layer formed on said insulator, and a transistor comprising a source region, a drain region, a gate region, and a channel region formed at the surface portion of said polycrystalline layer, said polycrystalline layer comprising crystal grains of an element selected from the group of Type-IV elements and the alloys thereof, said crystal grains joined with crystal grain boundaries of {111} twin of Diamond structure.

5. A thin-film semiconductor device as claimed in claim 4, wherein, in at least one current path connecting said source region and said drain region, at least one of the crystal grain boundaries crossing said current path is said {111} twin of Diamond structure.

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6. A thin-film semiconductor device as claimed in claim 4, wherein said insulator is a glass substrate, said polycrystalline layer is a Si thin-film, said Si thin-film has a thickness of 10 to 150 nm, and said Si thin-film has a plurality of crystal grains having {110} planes parallel to the surface of said substrate .

7. A thin-film semiconductor device as claimed in claim 4, wherein in said channel region the two to five crystal grains having the joints of said {111} twin have {110} planes parallel to the surface of said insulator, and have at least one structure

Sub B1 (cont) coupled at one point on said polycrystalline layer.

8. A thin-film semiconductor device as claimed in claim 4, wherein said polycrystalline layer has a structure where n-layer (n is 1 or larger) of semiconductor thin film is laminated, said transistor comprising said source region, drain region, channel region and gate electrode is formed at the surface of n-th semiconductor layer, the k-th (k = 1 to n) semiconductor layer has said poly-crystal having the larger crystal grain size as the value of k increases and the grain boundary of the n-th semiconductor layer has the {111} twin of Diamond structure.

9. A thin-film semiconductor device comprising an insulator, a semiconductor thin-film formed on said insulator and a transistor comprising a source region, a drain region, a channel region and a gate electrode formed at the surface of said semiconductor thin-film, said semiconductor thin-film having amorphous regions of Type-IV element and dendrite crystal regions of Type-IV element connecting said source region and said drain region.

10. A thin-film semiconductor device as claimed in claim 9, wherein, in at least one current path formed by said dendrite crystal region connecting said source region and said drain region, at least one of the crystal grain boundaries crossing said current path is {111} twin of Diamond structure.

11. A thin-film semiconductor device as claimed in claim 9, wherein said dendrite crystal regions are branching from one slender single crystal grain having {110} plane parallel to said substrate surface and {111} plane vertical to the major axis of the branch, said plurality of branches are joined with each other in any angle of 39.0° , 70.5° and 109.5° , and the joint surface thereof is {111} twin of Diamond structure.

Sub B27 12. A thin-film semiconductor device as claimed in claim 9 , wherein the two to five grains having the joints of {111} twins have {110} planes parallel to the surface of said insulator and at least one structure coupled at one point on said dendrite crystals, in said channel region.

13. A thin-film semiconductor device as claimed in claim 9, wherein said semiconductor thin-film has a structure where n-layer (n is 1 or larger) of semiconductor thin film is laminated, said transistor comprising said source region, said drain region, said channel region and said gate electrode is formed at the surface of the n-th semiconductor film, the k-th (k = 1 to n) semiconductor thin-film increases width and length of said dendrite crystal as the value of k increases, and the grain boundary of the n-th semiconductor thin-film has {111} twin of Diamond structure.

14. A thin-film semiconductor device comprising an insulating substrate, a poly-crystal semiconductor thin-film

formed on said insulating substrate and a transistor comprising a source region, a drain region, a channel region and a gate electrode formed at the surface of said poly-crystal semiconductor thin-film, said poly-crystal thin-film comprising crystal of an element selected from the group of Type-IV element and the alloy thereof, the crystal boundaries of said poly-crystal thin-film being {111} twin of Diamond structure, said poly-crystal thin-film having a seed metal layer of a metal M selected the group of Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ru, Rh, Pd, Ag, Os, Ir, Pt, Au and the alloy thereof, or of a compound MxAy of said metal M and said Type-IV element A (x and y are mixing crystal ratio of M and A), or of a layered structure of said metal M and said Type-IV element A provided at the surface thereof near said channel region of said transistor.

15. A thin-film semiconductor device comprising a semiconductor thin-film layer provided at the upper part of an insulator and an insulated-gate type semiconductor element formed at the surface portion of said semiconductor thin-film layer, said semiconductor thin-film layer having a bottle-neck region of which cross-section is reduced than the other area thereof at the periphery of said semiconductor element.

~~16. An~~ insulated-gate type thin-film semiconductor device comprising an insulator, a thin-film semiconductor layer having

a source region and a drain region which are separated from each other, a gate insulating film covering the surface of said semiconductor layer between said source region and said drain region, and a gate electrode separated from said semiconductor layer via said gate insulating film therebetween, said semiconductor layer between said source region and said drain region having the thickness of 10 to 150 nm and a polycrystalline surface with electron mobility of 260 to 500 $cm^2/(V \cdot s)$.

17. A thin-film semiconductor integrated circuit device comprising a plurality of thin-film semiconductor devices as claimed in claim 16 integrated on said insulator.

18. A liquid-crystal display device comprising a first thin-film integrated circuit having a plurality of first thin-film transistors to form the matrix element for the liquid-crystal display and a second thin-film integrated circuit having a plurality of second thin-film transistors to form the peripheral circuit driving said matrix element, both circuits integrally formed in a semiconductor thin-film layer provided at the upper part of one common insulating substrate, each of said thin-film transistors of said first thin-film integrated circuit and said second thin-film integrated circuit having a semiconductor active region formed of a plurality of semiconductor crystalline grains joined by {111} twin boundaries of Diamond structure between a source and a drain

~~thereof, and a liquid-crystal provided at the upper part of said first thin-film integrated circuit.~~

19. A liquid-crystal display device comprising a first thin-film integrated circuit having a plurality of first thin-film transistors to form the matrix element for the liquid-crystal display and a second thin-film integrated circuit having a plurality of second thin-film transistors to form the peripheral circuit driving said matrix element formed integrally in a semiconductor thin-film provided at the upper part of a common insulating substrate, each thin-film transistor forming said first and second thin-film integrated circuits comprising a poly-crystal semiconductor active region having the electron mobility of 260 to 500 $cm^2/(V \cdot s)$ between a source and a drain thereof, and a liquid-crystal member provided at the upper part of said first thin-film integrated circuit.

20. A liquid-crystal display device as claimed in claim 18, wherein said insulating substrate is formed of glass material and said liquid-crystal member has the liquid-crystal display area of the diagonal length of 15 inch or more.

21. A method of manufacturing a thin-film semiconductor device comprising the steps of forming a gate insulating film by oxidizing a surface of a semiconductor thin-film having a plurality of semiconductor crystalline grains joined by at least one {111} twin boundary of Diamond structure and forming a gate

electrode on said gate insulating film.

22. A method of manufacturing a thin-film semiconductor device comprising the steps of forming an amorphous semiconductor thin-film partially provided with a seed crystal metal at the surface thereof on a major surface of an insulator, and crystallizing said semiconductor thin-film with a direction from said seed crystal metal to said major surface of said insulator substrate by annealing said semiconductor thin-film.

23. A method of manufacturing a thin-film semiconductor device comprising the steps of depositing amorphous Si thin-film at the upper part of an insulator, providing seed crystal metal at the surface of said thin-film except for the surface of channel forming area, forming crystal grains of said Si joined by twin-boundaries in the surface of said thin-film in said channel forming area by heat treatment of said amorphous Si thin-film, and providing a gate electrode at the surface of said channel forming area of said Si thin-film via a gate insulating film.

24. A method of manufacturing a thin-film semiconductor device comprising the steps of depositing an amorphous Si thin-film with the thickness of 10 to 150 nm at the upper part of an insulator, providing seed crystal metal on the surface of said thin-film except for the surface of a channel forming area, annealing said amorphous Si thin-film at the temperature

of 600℃ or lower, and providing a gate electrode to the surface of said channel forming area of said Si thin-film via a gate insulating film.

25. A method of manufacturing a thin-film semiconductor device as claimed in claim 24, wherein said insulator is of a glass substrate and said amorphous Si thin-film is formed by heat treatment under the temperature range from 300℃ to 600℃.

26. A method of manufacturing a thin-film semiconductor device comprising the steps of depositing a first amorphous Si thin-film at the upper part of an insulator, providing a seed crystal metal to a first thin-film area except for an active region of the thin-film transistor, crystallizing said first Si thin-film by annealing, depositing a second amorphous Si thin-film at the upper part of said first Si thin-film thus-obtained, forming crystal grains of Si jointed by twin boundaries in said second thin-film area of the active region by annealing said second thin-film, providing a gate insulating film on the surface of said active region of said second thin-film, and providing a gate electrode on said gate insulating film.

27. A method of manufacturing a thin-film semiconductor device as claimed in claim 21, wherein said semiconductor thin-film is of the element selected from the group of Type-IV element and an alloy thereof.

28. A method of manufacturing a thin-film semiconductor device as claimed in claim 22, wherein said seed crystal metal is of the element selected from the group of Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ru, Rh, Pd, Ag, Os, Ir, Pt and Au, alloys thereof, and compounds of said metal and Type-IV element, or is of a laminated structure of said metal and said Type-IV element.

29. A method of manufacturing a thin-film semiconductor device as claimed in claim 23, wherein a bottle-neck region is formed between said seed crystal metal and the channel forming surface area in said amorphous thin-film before conducting said heat treatment, by selectively removing a part of said amorphous thin-film .

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~~30. A thin-film semiconductor integrated circuit device comprising a semiconductor thin-film layer provided at the upper part of an insulator, a plurality of insulated- gate type semiconductor elements formed at said semiconductor thin-film layer, each of said semiconductor elements having a gate electrode separated from said semiconductor thin-film layer by a gate insulating film at the surface of said semiconductor thin-film layer, and a seed crystal metal located between at least two of said gate insulating films and provided on the surface of said semiconductor thin-film layer except for the areas just under said gate insulating films.~~

31. A thin-film semiconductor integrated circuit device as claimed in claim 30, wherein said semiconductor thin-film layer in contact with said gate insulating film has semiconductor crystalline grains joined by {111} twin boundaries of Diamond structure.

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~~32. A thin-film semiconductor integrated circuit device, comprising a semiconductor thin-film layer provided at the upper part of an insulator and a plurality of insulated-gate type semiconductor elements formed at said semiconductor thin-film layer, wherein said semiconductor thin-film located between said semiconductor elements is provided with a bottle-neck region of which cross-sectional area is smaller than that of the other portions.~~

33. A thin-film semiconductor integrated circuit device as claimed in claim 32, wherein each of said insulated-gate type semiconductor elements has a channel region on said semiconductor thin-film layer and said channel region is formed of a plurality of semiconductor crystalline grains joined by {111} twin boundaries of Diamond structure.

~~34. A semiconductor device comprising a semiconductor region having a plurality of semiconductor crystalline grains joined by {111} twin boundaries of Diamond structure, and a semiconductor element having an active region thereof within said semiconductor region.~~

add a3

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